

Sugar Price Supports and Taxation

A Public Health Policy Paradox

Abby Dilk, BS

Dennis A. Savaiano, PhD

Domestic US sugar production has been protected by government policy for the past 82 years, resulting in elevated domestic prices and an estimated annual (2013) \$1.4 billion dollar “tax” on consumers. These elevated prices and the simultaneous federal support for domestic corn production have ensured a strong market for high-fructose corn syrup. Americans have dramatically increased their consumption of caloric sweeteners during the same period. Consumption of “empty” calories (ie, foods with low-nutrient/high-caloric density)—sugar and high-fructose corn syrup being the primary sources—is considered by most public health experts to be a key contributing factor to the rise in obesity. There have been substantial efforts to tax sugar-sweetened beverages (SSBs) to both reduce consumption and provide a source of funds for nutrition education, thereby emulating the tobacco tax model. Volume-based SSB taxes levy the tax rate per ounce of liquid, where some are only imposed on beverages with added sugar content exceeding a set threshold. Nonetheless, volume-based taxes have significant limitations in encouraging consumers to reduce their caloric intake due to a lack of transparency at the point of purchase. Thus, it is hypothesized that point-of-purchase, nutrient-specific

excise taxes on SSBs would be more effective at reducing sugar consumption. However, all SSB taxes are limited by the possibility that consumers may compensate their decreased intake from SSBs with other high-calorie junk foods. Furthermore, there are no existing studies to provide evidence on how SSB taxes will impact obesity rates in the long term. The paradox of sugar prices is that Americans have paid higher prices for sugar to protect domestic production for more than 80 years, and now, Americans are being asked to pay even more to promote public health. The effective use of sugar taxes should be considered based on their merits in reducing sugar consumption and making available a new source of funds to support nutrition education, not on lobbying efforts by the food industry or sugar and corn producers. *Nutr Today*. 2017;52(3):143–150

HISTORY OF SUGAR PRICE SUPPORTS

Americans consumed 12 million tons of refined sugar in 2013, with each pound costing 6 cents more than the international average price. Thus, Americans paid \$1.4 billion extra for sugar in 2013.¹ Despite this tariff, which has been in place for many years, the average consumption of added sugars by American adults has increased by 30% since 1977.² How does this dichotomy of inflated domestic sugar prices and ever increasing sugar consumption make sense? Sugar price control started with the Sugar Act of 1934 during the Great Depression.³ Quotas on domestic sugar production, foreign imports, and advertisements were issued under the act, as well as a one-half cent per pound subsidy for beet and sugarcane sugar—the primary sugar crops in the United States.³ The Sugar Act, which was meant to stimulate the American economy, expired 40 years later in 1974.³ Then in 1976, President Ford tripled the import tariff on sugar.³ The International Trade Commission advised President Carter in 1977 to establish a quota for sugar imports in light of their threat to the domestic sugar industry.³ Rather than establishing an import quota, President Carter championed a payment program for sugar farmers, offering “supplemental payments of up to two cents a pound whenever the market price [fell] below 13.5 cents per pound.”⁴ The Agriculture and Food Act of 1981 further increased sugar price support levels.³ President Reagan reintroduced country-by-country import

Abby Dilk, BS, earned a BS in Nutrition Science, with minors in biology and chemistry, from Purdue University in 2016. Dilk is currently earning her Master's in Public Health Nutrition at the George Washington University.

Dennis A. Savaiano, PhD, is the Virginia Meredith Professor of Nutrition Policy at Purdue University. Dr Savaiano has degrees from Claremont McKenna College (BA in Biology) and the University of California at Davis (MS and PhD in Nutrition). He was a professor in the Department of Food Science and Nutrition at the University of Minnesota from 1980 through 1995 and Dean of Consumer and Family Sciences at Purdue University from 1995 to 2010.

Purdue University provided funding to allow this article to publish as open access.

Dr Savaiano is chair of the Ritter Pharma Medical advisory board, and is a member of the Dannon Nutrition Advisory Board. Ms Dilk has no conflicts of interest to disclose.

Correspondence: Dennis A. Savaiano, PhD, Department of Nutrition Science, Purdue University, 700 West State St, West Lafayette, IN 47906 (savaiano@purdue.edu).

This is an open-access article distributed under the terms of the Creative Commons Attribution-Non Commercial-No Derivatives License 4.0 (CCBY-NC-ND), where it is permissible to download and share the work provided it is properly cited. The work cannot be changed in any way or used commercially without permission from the journal.

Copyright © 2017 The Authors. Published by Wolters Kluwer Health, Inc.

DOI: 10.1097/NT.0000000000000217

quotas in an attempt to keep market prices high.³ Later in his presidency in 1985, Reagan signed the Food Security Act but pushed to reduce the sugar price support program, which he viewed as a “counterproductive” program that “poses significant problems in the areas of trade policy, foreign policy, and agricultural policy.”^{3,5} The Food, Agriculture and Trade Act of 1990, as endorsed by President George H.W. Bush, supported the sugar industry by establishing marketing allotments and marketing assessments—the former of which limits how much of certain commodities can be sold and the latter being monetary contributions collected from sugar producers and first purchasers that reduce the budget deficit target.³ President Clinton fixed refined beet and raw cane sugar loan rates at 22.9 and 0.18 cents, respectively, when he signed the Agricultural Improvement and Reform Act in 1996.³ In addition, limits on sugar marketing were repealed, and an increase of 0.25 cent/lb was instituted for marketing assessments.³ Then in 2008, President George W. Bush vetoed The Farm Bill, which supported the existing sugar program but simultaneously increased sugar loan rates and limited the Secretary of Agriculture’s ability to increase the refined sugar import quota.⁶ President Bush’s veto was overridden by the House and the Senate, thereby continuing the existing sugar regulation for 4 more years.³ In 2012, Congress further extended the sugar program until September 30, 2013.³ Most recently, the Agricultural Act of 2014 left the sugar program unchanged.³ Thus, for the past 80 years, federal laws have protected sugar farmers by limiting sugar imports, leading to higher sugar prices for US consumers. Corn syrup is not taxed, but corn has been strongly supported in farm bills. For the past decades, it has a less expensive source of sugar than cane.

SUBSTITUTION OF SUGAR WITH HIGH-FRUCTOSE CORN SYRUP

Food companies have successfully avoided high sugar prices by using sugar’s less expensive substitute, high-fructose corn syrup (HFCS). For comparison, the average wholesale prices of beet sugar and HFCS during the 2000s were 27.33 and 21.72 cents/lb, respectively.^{7,8} The price of US beet sugar soared from 2009 to 2012 as a result of low sugar production around the world when adverse weather negatively impacted many sugar farms.⁹ High-fructose corn syrup prices steadily increased during the 2000s because of drought-induced US corn production declines.¹⁰ Thus, inclement weather has resulted in a marginal cost difference between HFCS and beet sugar. However, beet sugar was still 2.79 and 0.10 cents higher than HFCS-42 and HFCS-55, respectively, in 2015.^{7–10} High-fructose corn syrup is a liquid sweetener made by extracting corn syrup from corn starch using chemical and enzymatic cleavage.¹¹ α -Amylase and glucoamylase hydrolyze corn

starch to corn syrup containing mainly glucose, and glucose isomerase converts some of the glucose to fructose. This process modifies corn syrup’s composition to have a slightly higher percentage of fructose than glucose. Corn has historically been a heavily subsidized crop grown in large midwestern monocrop fields.¹⁰ Subsidized production and advanced technology are responsible for the efficiency and low cost of HFCS, which can be found in virtually all processed foods such as ketchup, breads, salad dressings, yogurts, fast food, ice cream, and soda.¹⁰ The Global Development and Environment Institute and Tufts University report that “the annual per-capita consumption of caloric sweeteners has increased by 40 pounds in the last 40 years, and high-fructose corn syrup accounts for 81% of the 83 additional calories the average American consumes each day from sweeteners alone.”¹² Thus, it would seem that the increased use of HFCS is due both to sugar import quotas (resulting in higher sugar prices) and historical corn subsidies. Furthermore, corn subsidies also aid the livestock industry, which purchases much of America’s corn harvest as feed for its chickens, pigs, and cows.¹² It is reported that purchasing livestock that were fed primarily subsidized grain (ie, corn) saved chicken processors \$11.3 billion, pork processors \$8.5 billion, and dairy processors \$6.6 billion between 1997 and 2005.¹² Hence, the sugar program involves and benefits more than only sugar farmers (Figure).

SUGAR-SWEETENED BEVERAGE TAXES AND PUBLIC HEALTH INITIATIVES

Public health efforts to decrease consumption of sugar-sweetened beverages (SSBs), which include regular soft drinks, energy and sports drinks, fruit drinks that are not 100% fruit juice, and sweetened teas and coffees, include taxation, emulating tobacco taxation. High cigarette and tobacco product taxes seemed to be very successful in reducing smoking rates.¹³ Furthermore, funds generated from tobacco taxes have often been directed toward public health initiatives that promote tobacco education and tobacco control programs, presumably leading to further reductions in tobacco use.¹³ Sugar taxation intends to generate a similar effect, with the goals of decreasing caloric intake of nutrient poor foods. Currently, 35 states and the District of Columbia have sales taxes on sodas sold in grocery stores, and 40 states and the District of Columbia have sales taxes on sodas sold in vending machines (see Table 1).^{14,15} However, such small taxes seem to be ineffective at reducing the consumption of regular soda. Price elasticity is a measure of the responsiveness of the demand for a product when its price is changed and can help us better understand how effective soda taxes are on decreasing consumption. On the basis of a systematic

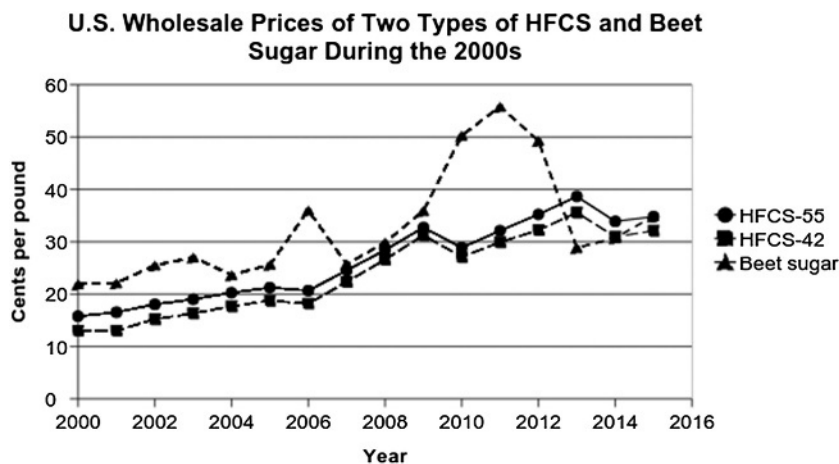


FIGURE. Wholesale price trends of beet sugar, HFCS-55, and HFCS-42 since the year 2000.^{7,8}

literature review, soft drinks reportedly have a price elasticity range of 0.13 to 3.18 and a mean price elasticity of 79%.¹⁶ Thus, “assuming no substitution of soft drinks with other caloric beverages and no change in other factors affecting purchasing behavior,” researchers’ estimates of the price elasticity of soft drinks “suggest that a 10% tax on soft drinks could lead to an 8% to 10% reduction in purchases of these beverages.”¹⁶ Thus, it is proposed that an excise tax of 1 cent/oz on SSBs would prompt a minimum reduction of 10% of calorie consumption from sugary drinks, which amounts to 20 kcal per person per day.¹⁷ A reduction of that level seems to be sufficient to produce weight loss and reduction in the risk of obesity and diabetes.¹⁷ However, this assumes no caloric compensation from other foods, which is theoretically unlikely. A smaller increase in price would probably not affect purchasing decisions, especially among the poor who might have a lower elasticity for purchase¹⁷ (Table 2). A product-specific excise tax is preferred (vs a sales tax) by many economists because it is based on a characteristic (ie, volume, calories, or nutrients) of the product rather than price.¹⁷ Furthermore, with a sales tax, consumers would likely become aware of the tax only after deciding to purchase the drink, and refills of fountain drinks would go untaxed.¹⁷ An excise tax, however, would be imposed on producers and wholesalers, who would then pass on the cost to retailers and consumers. Thus, consumers are aware of the total cost of SSBs, sugar taxes included, at the time of purchase.¹⁷ This approach is currently implemented in Berkeley, California.¹⁸ It is estimated that 47% of the tax of 1 cent/oz has been successfully passed through to the retail price for SSBs in Berkeley.¹⁹ Furthermore, SSB consumption has decreased by 21% in Berkeley in the year since the tax’s enactment, whereas SSB consumption in comparison cities without SSB taxes, such as Oakland and San Francisco, increased by 4%.²⁰ An alternative method of taxation is to tax SSBs by calories. A tax of 0.04 cent per calorie on sugar drinks would re-

portedly decrease an individual’s caloric intake by 5800 calories per year, assuming no caloric compensation.²¹ Thus, an excise tax of 0.04 cent per calorie has the power to reduce the consumption of beverage calories by 9.3%, whereas a tax of 0.5 cent/oz would result in a lesser 8.6% reduction.²² Researchers note that “this is attributed to the fact that a tax on caloric content can achieve a reduction in calories consumed from sugar-sweetened beverages at less of a cost to the consumer than a volume-based tax.”²² In fact, a 0.04-cent, calorie-based tax would save consumers an estimated \$736 million per year in comparison with a tax of 1 cent/oz.²² A nutrient-specific tax has also been proposed to tax SSBs. By applying a 20% tax that is directly proportional to the percentage of sugar in the formula of ingredients, sugar consumption and overall caloric intake can purportedly be decreased by 16.41% and 18.54%, respectively.²³ Thus, of the possible approaches to taxing SSBs, a nutrient-based tax for sugar-containing drinks may prove to be most effective at decreasing SSB consumption due to its ability to reduce caloric intake to a greater degree than both product- and calorie-based taxes.

LIMITATIONS OF SSB TAXES

Although SSBs show promise in reducing obesity rates, evidence supporting this claim has significant limitations. In regard to volume-, calorie-, and nutrient-specific taxes, the increased likelihood of consumers substituting SSBs with beverages containing artificial sweeteners is a significant possible outcome for each taxation method because consumers may still seek out sweet beverages.²² Furthermore, there is some concern that a tax-induced decrease in calories from SSBs could result in consumers compensating with calorically similar, untaxed foods and other beverages such as orange juice or chocolate milk.²⁴ A study examining substitution in regard to a 20% sales tax on SSBs found a statistically significant substitution

TABLE 1 State Sales Taxes on Regular Soda¹⁴

| State | Sales Tax on Regular Soda Sold in Food Stores, % | Sales Tax on Regular Soda Sold in Vending Machines, % | Sales Tax on Regular Soda Higher Than Tax on Food Generally | Sales Tax on Regular Soda Sold Through Vending Machine Higher Than Tax on Food Generally | Mandatory Statewide Local Tax in Addition to Soda Sales Tax, % |
|-----------------|--|---|---|--|--|
| AL | 4.0 | 4.0 | | | 0.0 |
| AK | 0.0 | 0.0 | | | 0.0 |
| AZ | 0.0 | 0.0 | | | 0.0 |
| AR ^a | 1.5 | 1.5 | | | 0.0 |
| CA | 6.5 | 6.5 | ✓ | ✓ | 1.0 |
| CO | 2.9 | 2.9 | ✓ | ✓ | 0.0 |
| CT | 6.4 | 6.4 | ✓ | ✓ | 0.0 |
| DE | 0.0 | 0.0 | | | 0.0 |
| DC | 5.8 | 5.8 | ✓ | ✓ | 0.0 |
| FL | 6.0 | 6.0 | ✓ | ✓ | 0.0 |
| GA | 0.0 | 4.0 | | ✓ | 0.0 |
| HI | 4.0 | 4.0 | | | 0.0 |
| ID | 6.0 | 6.0 | | | 0.0 |
| IL | 6.3 | 6.3 | ✓ | ✓ | 0.0 |
| IN | 7.0 | 7.0 | ✓ | ✓ | 0.0 |
| IA | 6.0 | 6.0 | ✓ | ✓ | 0.0 |
| KS | 6.2 | 6.2 | | | 0.0 |
| KY | 6.0 | 6.0 | ✓ | ✓ | 0.0 |
| LA | 0.0 | 0.0 | | | 0.0 |
| ME | 5.5 | 5.5 | ✓ | ✓ | 0.0 |
| MD | 6.0 | 6.0 | ✓ | ✓ | 0.0 |
| MA | 0.0 | 0.0 | | | 0.0 |
| MI | 0.0 | 0.0 | | | 0.0 |
| MN | 6.9 | 6.9 | ✓ | ✓ | 0.0 |
| MS | 7.0 | 8.0 | | ✓ | 0.0 |
| MO | 1.2 | 1.3 | | | 0.0 |
| MT | 0.0 | 0.0 | | | 0.0 |
| NE | 0.0 | 5.5 | | ✓ | 0.0 |
| NV | 0.0 | 0.0 | | | 0.0 |

TABLE 1 State Sales Taxes on Regular Soda¹⁴, Continued

| State | Sales Tax on Regular Soda Sold in Food Stores, % | Sales Tax on Regular Soda Sold in Vending Machines, % | Sales Tax on Regular Soda Higher Than Tax on Food Generally | Sales Tax on Regular Soda Sold Through Vending Machine Higher Than Tax on Food Generally | Mandatory Statewide Local Tax in Addition to Soda Sales Tax, % |
|-----------------|--|---|---|--|--|
| NH | 0.0 | 0.0 | | | 0.0 |
| NJ | 7.0 | 7.0 | ✓ | ✓ | 0.0 |
| NM | 0.0 | 5.1 | | ✓ | 0.0 |
| NY | 4.0 | 4.0 | ✓ | ✓ | 0.0 |
| NC | 4.8 | 4.8 | ✓ | ✓ | 0.0 |
| ND | 5.0 | 5.0 | ✓ | ✓ | 0.0 |
| OH | 5.8 | 5.8 | ✓ | ✓ | 0.0 |
| OK | 4.5 | 4.5 | | | 0.0 |
| OR | 0.0 | 0.0 | | | 0.0 |
| PA | 6.0 | 6.0 | ✓ | ✓ | 0.0 |
| RI ^a | 7.0 | 7.0 | ✓ | ✓ | 0.0 |
| SC | 0.0 | 6.0 | | ✓ | 0.0 |
| SD | 4.0 | 4.0 | | | 0.0 |
| TN ^a | 5.0 | 5.0 | | | 0.0 |
| TX | 6.3 | 6.3 | ✓ | ✓ | 0.0 |
| UT | 1.8 | 1.8 | | | 1.3 |
| VA ^a | 1.5 | 5.3 | | ✓ | 0.0 |
| VT | 6.0 | 6.0 | ✓ | ✓ | 0.0 |
| WA ^a | 6.5 | 6.5 | ✓ | ✓ | 0.0 |
| WV ^a | 6.0 | 6.0 | ✓ | ✓ | 0.0 |
| WI | 5.0 | 5.0 | ✓ | ✓ | 0.0 |
| WY | 0.0 | 4.0 | | ✓ | 0.0' |

The check mark (✓) indicates higher than general tax.

^aThese states also impose additional, nonsales taxes/fees on bottles, syrups, and/or powders/mixes at the manufacturer, wholesaler, distributor, and/or retailer levels.

of SSBs with fruit juices (+2.5 kcal/d) and canned soups (+1.9 kcal/d).²⁵ On the other hand, taxation of SSBs did not affect cookie and candy consumption, and it even caused a decrease in salty snack (−6.3 kcal/d) and ice cream (−4.8 kcal/d) consumption.²⁵ These observations may be more or less prominent in the proposed taxes of 1 cent/oz, 0.04 cent per calorie, and 20% nutrient specific.²⁵ As evidenced by Denmark's failed "fat tax" on foods

containing more than 2.3% of saturated fat, pairing junk food taxes with subsidies on healthy foods such as fruits and vegetables may prevent consumers from substituting 1 unhealthy habit (eg, high-fat food consumption) for another (eg, soda consumption).²⁶

Because SSB taxes are a relatively recent phenomenon, research on the effectiveness of SSB taxes in reducing the incidence of overweight and obesity is limited to modeling

TABLE 2 Descriptions of Various SSB Tax Models

| Type of SSB Tax | How the Tax Works |
|--|--|
| Sales tax | Calculated as a percentage of the retail sales price and paid by consumers at the point of sale |
| Excise tax | Imposed on producers and/or sellers; can be passed onto consumers in the retail shelf price of a product |
| Volume-based excise tax | Tax rate applied per ounce; a sugar threshold may need to be surpassed to apply |
| Calorie-based excise tax | Tax rate applied per calorie |
| Nutrient-specific excise tax | Tax rate proportionally applied to percentage of sugar content |
| Abbreviation: SSB, sugar-sweetened beverage. | |

studies. For example, a tax of 25 cents/L (ie, volume-based excise tax) has been estimated to reduce obesity rates by 1.3% in the United Kingdom.²⁷ Furthermore, there are inadequate data available on whether SSB taxes are capable of sustaining decreases in SSB purchases and consumption long term. During the first year of Mexico's volume-based excise tax of 1 peso/L on nondairy and nonalcoholic beverages with added sugar, SSB purchases decreased by 6%, whereas purchases of untaxed beverages (especially bottled water) increased by 3.9%.²⁸ Still, the full extent of purchasing substitutions is not yet known. Thus, long-term monitoring to understand purchasing changes and potential indicators on health is needed. We conclude that public health officials advocating for SSB taxes need additional evidence to support claims that SSB taxes can ultimately decrease the magnitude of the ongoing obesity epidemic. There has been significant controversy related to the long-term effect of Mexico's SSB tax on soda sales. In May 2016, The Wall Street Journal reported a collective 16.5% increase in soda sales since 2015 for Coca-Cola's 2 major Mexican bottling companies.²⁹ The soda industry used these data as evidence to their claim that SSB taxes are fruitless but did not correct for these sales statistics that were based on total aggregate sales. That is, they did not account for population rise, inflation, unemployment rates, or other socioeconomic factors affecting consumption.³⁰ Independent results that did correct for concurrent factors suggested decreases in SSB consumption. However, it is difficult to effectively assess the tax's sustainability and durability at such an early stage in its implementation. It is also unclear as to how a tax on SSBs might impact the overall health of children. One economic modeling study

suggested that a tax of penny per ounce on SSBs would result in a 2.4% decrease in childhood obesity—a greater effect than after-school physical activity programs and banning fast food advertising targeted at children.³¹ However, researchers also reported that, although a 20% SSB tax may decrease caloric and added sugar intake in preschoolers, it may not improve diet quality.³² Specifically, unfavorable changes in fatty acid profile, total protein, and vegetable and fruit intake were noted. These inconsistencies reinforce the argument that the impact of SSB taxes on children should be closely monitored and evaluated.

Even without overwhelming evidence that SSB taxes will reduce SSB consumption and obesity rates, SSB taxes still may be a viable approach to funding public health programs, including nutrition education, physical activity, and improved access to healthy foods.¹³ However, directing tax revenues toward broader public needs may improve the likelihood of SSB tax enactment, as seen in the passage of Philadelphia's tax of 1.5 cents/oz on sugar-sweetened and diet drinks.³³ The tax proposal did not issue a "nanny state" agreement; instead, it directed SSB tax funds toward public programs such as universal prekindergarten and park improvements.³³ Moreover, it is doubtful that SSB taxes are a magic bullet in addressing the growing concern for obesity. To have the greatest impact, SSB taxes likely need to be accompanied by nutrition education and an array of policies that would require sugar warning labels on products and advertisements, decrease SSB availability, and regulate health claims.

LOBBYING BY SODA COMPANIES, THE HFCS INDUSTRY, AND PUBLIC HEALTH

Although sugar represents only 2% of the total value of US crop production, 35% of all crop industries' total campaign donations and 40% of all crop industries' total lobbying expenditures apparently come from the sugar industry.¹ In light of recent attempts to tax SSBs, the beverage industry created Americans Against Food Taxes.³⁴ This group is funded by more than 400 companies involved in food production and distribution, including National Association of Convenience Stores, Corn Refiners Association, American Beverage Association, Grocery Manufacturers Association, National Supermarkets Association, Florida Chamber of Commerce, Georgia Agribusiness Council, National Association of Theater Owners, and National Retail Federation, among others. From 2006 to 2008, the lobbying budget of Americans Against Food Taxes was \$1 million. However, their budget grew to \$20 million in 2009.

The American Beverage Association and soda companies have spent at least a combined \$106 million on lobbying and issue ads between 2009 and 2015.³⁵ This figure is

likely much higher, considering that campaign and lobby expenses data are not available from “10 out of the 23 jurisdictions that have considered policies aimed at reducing sugar-drink consumption.” A 2013 example of food industry expenditure to prevent soft drink regulation was their response to the efforts of New York Mayor Michael Bloomberg to limit the size of SSBs to no more than 16 oz.³⁶ The beverage industry spent \$15.2 million to combat this effort, which was eventually ruled illegal. The judge in the case called the law “arbitrary and capricious.”^{35,36} At the same time, the American Beverage Association adopted an education approach while condemning taxes on SSBs.³⁴ Their stance was that Americans cannot be taxed into better health—only education can help Americans make better food choices.

Likewise, public health advocates have also engaged in lobbying to support SSB taxes. Philadelphians for a Fair Future, a nonprofit organization funded mainly by billionaires Michael Bloomberg and John and Laura Arnold, spent \$2.1 million on ads, polls, and staff to support Philadelphia’s soda tax, as compared with the \$10.6 million spent by the American Beverage Association to oppose the tax. Interestingly, the soda industry branded the tax as a “grocery tax,” thereby suggesting that the tax applies to more than SSBs.³⁷

SUMMARY

America has long been balancing the economic need to maintain domestic sugar production, support domestic agriculture, and promote the health of its citizens. Sugar policies support our nation’s sugar and corn farmers. However, without the sugar program, sugar in the United States would be less expensive. Taxing SSBs, because they are a very significant source of empty calories in most Americans’ diets, is a public health strategy aimed at reducing obesity. This tax could be volume, calorie, or nutrient based; however, a nutrient-specific tax is theoretically the most effective at decreasing consumption of sugary drinks due to its ability to produce the greatest decrease in caloric intake. The revenue generated from such a tax could be used to fund public health initiatives that would encourage healthy eating patterns and physical activity. If they really can reduce caloric intakes, sugar taxation efforts might ultimately reduce rates of diabetes and obesity. The paradox of sugar prices is that Americans have paid higher prices for sugar to protect domestic production for more than 80 years, and now, Americans are paying even higher prices for sugar to promote public health. The effective use of sugar taxes should be considered based on their merits in reducing sugar consumption and making available a new source of funds to support nutrition education, not on lobbying efforts by the food industry or sugar and corn producers.

REFERENCES

1. Riley B. US trade policy gouges American sugar consumers. *The Heritage Foundation*. <http://www.heritage.org/research/reports/2014/06/us-trade-policy-gouges-american-sugar-consumers>. Accessed February 10, 2016.
2. The Obesity Society. US adult consumption of added sugars increased by more than 30% over three decades. <http://www.obesity.org/news/press-releases/us-adult>. Accessed February 12, 2016.
3. Coalition for Sugar Reform. History of the sugar program. <http://sugarreform.org/why-reform/history-of-the-sugar-program/>. Accessed February 10, 2016.
4. Carter J. American sugar industry letter to the speaker of the house and the president of the senate transmitting a report. The American Presidency Project. <http://www.presidency.ucsb.edu/ws/?pid=7453>. Accessed February 15, 2016.
5. Reagan R. *Public Papers of the Presidents of the United States, Ronald Reagan: 1988–89*. Washington, DC: US Government Printing Office; 1991:213.
6. Sweetener Users Association. Sugar provisions of the 2008 Farm Bill. <http://www.sweetenerusers.org/2008%20Farm%20Bill%20Sugar%20Provisions.pdf>. Accessed February 13, 2016.
7. United States Department of Agriculture Economic Research Service. Sugar and sweeteners yearbook tables: table 5—U.S. wholesale refined beet sugar price, Midwest markets, monthly, quarterly, and by calendar and fiscal year. <http://www.ers.usda.gov/data-products/sugar-and-sweeteners-yearbook-tables.aspx#25442>. Updated March 6, 2016. Accessed March 10, 2016.
8. United States Department of Agriculture Economic Research Service. Sugar and sweeteners yearbook tables: table 9—U.S. price for high fructose corn syrup (HFCS), Midwest markets, monthly, quarterly, and by calendar and fiscal year. <http://www.ers.usda.gov/data-products/sugar-and-sweeteners-yearbook-tables.aspx#25442>. Updated March 6, 2016. Accessed March 10, 2016.
9. Brester G. 20 years in, NAFTA finally sours the US sugar program. American Enterprise Institute. <http://aei.org/wp-content/uploads/2014/09/-20-years-in-nafta-finally-sours-the-us-sugar-program:162748881632.pdf>. Accessed February 17, 2016.
10. Plumer B. A brief history of U.S. corn, in one chart. *Washington Post*. August 16, 2012. <http://www.washingtonpost.com/blogs/ezra-klein/wp/2012/08/16/a-brief-history-of-u-s-corn-in-one-chart/>. Accessed February 12, 2016.
11. Parker K, Salas M, Nwosu VC. High fructose corn syrup: production, uses and public health concerns. *Biotechnol Mol Biol Rev*. 2010;5(5):71–78. <http://www.academicjournals.org/journal/BMBR/article-full-text-pdf/41CAC0411547>. Accessed February 25, 2016.
12. Harvie A, Wise T. Sweetening the plot: implicit subsidies to corn sweeteners and the U.S. obesity epidemic. Global Development and Environment Institute Policy Brief no. 09-01. <http://www.ase.tufts.edu/gdae/Pubs/rp/PB09-01SweeteningPotFeb09.pdf>. Accessed July 15, 2016.
13. Chaloupka F, Powell L, Chiqui J. Sugar-sweetened beverage taxation as public health policy—lessons from tobacco. *Choices*. 2011;26(3). http://ageconsearch.umn.edu/bitstream/117065/2/cmsarticle_187.pdf. Accessed February 14, 2016.
14. Olsen S. Sales tax for soft drinks, other laws go into effect July 1. *VTDigger*. June 30, 2015. <http://vtdigger.org/2015/06/30/sales-tax-for-candy-and-soft-drinks-starts-wednesday/>. Accessed August 5, 2016.
15. Chiqui JF, Eidson SS, Chaloupka FJ. State sales taxes on regular soda (as of January 1, 2014). *Bridging the Gap*. http://www.bridgingthegapresearch.org/_asset/s2b5pb/BTG_soda_tax_fact_sheet_April2014.pdf. Accessed February 19, 2016.
16. Andreyeva T, Long MW, Brownell KD. The impact of food prices on consumption: a systematic review of research on the

price elasticity of demand for food. *Am J Public Health*. 2010; 100(2):216–222.

17. Rampell C. Britain's flat idea to tax soda and other sugar drinks. *Washington Post*. March 22, 2016. https://www.washingtonpost.com/opinions/britains-flat-idea-to-tax-soda-and-other-sugary-drinks/2016/03/21/186e3ad0-efa1-11e5-89c3-a647fccc95e0_story.html?postshare=9821458731278020&tid=ss_mail. Accessed March 24, 2016.
18. Yang S. Berkeley's soda tax boosts retail prices of sugary drinks, study confirms. *Berkeley News*. October 7, 2015. <http://news.berkeley.edu/2015/10/07/soda-tax-boosts-sugary-drink-prices/>. Accessed February 12, 2016.
19. Falbe J, Rojas N, Grummon AH, Madsen KA. Higher retail prices of sugar-sweetened beverages 3 months after implementation of an excise tax in Berkeley, California. *Am J Public Health*. 2015;105(11):2194–2201.
20. Falbe J, Thompson HR, Becker CM, Rojas N, McCulloch CE, Madsen KA. Impact of the Berkeley excise tax on sugar-sweetened beverage consumption. *Am J Public Health*. 2016;106(10):1865–1871. <http://www.ncbi.nlm.nih.gov/pubmed/?term=Impact+of+the+Berkeley+Excise+Tax+on+Sugar-21.Sweetened+Beverage+Consumption+++Read+More%3A+http%3A%2F%2Fajph.aphapublications.org%2Fdoi%2Fabs%2F10.2105%2FAJPH.2016.303362>. Accessed August 25, 2016.
21. Zhen C, Brissette IF, Ruff RR. By ounce or by calorie: the differential effects of alternative sugar-sweetened beverage tax strategies. *Am J Agr Econ*. 2014;96(4):1070–1083.
22. Robert Wood Johnson Foundation. To combat obesity, tax calories, not ounces. <http://www.rwjf.org/en/library/articles-and-news/2014/06/study-predicts-tax-on-calories-in-sugar-sweetened-beverages-woul.html>. Accessed February 1, 2016.
23. Harding M, Lovenheim M. The effects of prices on nutrition: comparing the impact of product- and nutrient-specific taxes. *The National Bureau of Economic Research*. <http://www.nber.org/papers/w19781.pdf>. Accessed March 24, 2016.
24. Fletcher J, Frisvold D, Tefft N. Substitution patterns can limit the effects of sugar-sweetened beverage taxes on obesity. *Prev Chronic Dis*. 2013;10:E18.
25. Finkelstein EA, Zhen C, Bilger M, Nonnemaker J, Farooqui AM, Todd JE. Implications of a sugar-sweetened beverage (SSB) tax when substitutions to non-beverage items are considered. *J Health Econ*. 2013;32(1):219–239.
26. Khazan O. What the world can learn from Denmark's failed fat tax. *The Washington Post*. November 11, 2012. <http://www.washingtonpost.com/news/worldviews/wp/2012/11/11/what-the-world-can-learn-from-denmarks-failed-fat-tax/>. Accessed July 28, 2016.
27. Briggs AD, Mytton OT, Kehlbacher A, Tiffin R, Rayner M, Scarborough P. Overall and income specific effect on prevalence of overweight and obesity of 20% sugar sweetened drink tax in UK: econometric and comparative risk assessment modelling study. *BMJ*. 2013;347:f6189.
28. Colchero MA, Popkin BM, Rivera JA, Ng SW. Beverage purchases from stores in Mexico under the excise tax on sugar sweetened beverages: observational study. *BMJ*. 2016;352:h6704.
29. Guthrie A, Esterl M. Soda sales in Mexico rise despite tax. *The Wall Street Journal*. May 3, 2016. <http://www.wsj.com/articles/soda-sales-in-mexico-rise-despite-tax-1462267808>. Accessed August 10, 2016.
30. Blackmore W. Does a jump in soda sales mean Mexico's soda tax isn't working? *takepart*. May 4, 2016.
31. Kristensen AH, Flottemesch TJ, Maciosek MV, et al. Reducing childhood obesity through U.S. federal policy: a microsimulation analysis. *Am J Prev Med*. 2014;47(5):604–612.
32. Ford CN, Poti JM, Ng SW, Popkin BM. SSB taxes and diet quality in US preschoolers: estimated changes in the 2010 Healthy Eating Index. *Pediatr Obes*. 2017;12(2):146–154. <http://onlinelibrary.wiley.com/doi/10.1111/ijpo.12121/epdf>. Accessed July 26, 2016.
33. Cohen L. Philadelphia passes soda tax after Mayor rewrites playbook. *Reuters*. June 16, 2016. <http://www.reuters.com/article/us-beverages-philadelphia-sodatax-idUSKCN0Z22G3>. Accessed August 4, 2016.
34. Luz M. The new policy battlefield: all eyes on Coca-Cola and social media PR. *The Huffington Post*. May 25, 2011. http://www.huffingtonpost.com/martin-luz/the-new-policy-battlefiel_b_470656.html. Accessed February 12, 2016.
35. Center for Science in the Public Interest. Soda industry spending against public health tops \$100 million. <http://www.cspinet.org/new/201508251.html>. Accessed February 11, 2016.
36. Grynbaum M. Judge blocks New York City's limits on big sugary drinks. *The New York Times*. March 11, 2013. http://www.nytimes.com/2013/03/12/nyregion/judge-invalidates-bloombergs-soda-ban.html?_r=0. Accessed February 13, 2016.
37. Colaneri K. Here's who bankrolled Philadelphia's pro-soda tax effort. *NewsWorks*. August 2 2016. <http://www.newsworks.org/index.php/local/philadelphia/95950-heres-who-bankrolled-philadelphias-pro-soda-tax-effort>. Accessed August 27, 2016.